



# Surgical Management of Inguinal Hernia

## Research Focus for Clinicians

A systematic review of 151 clinical studies published between January 1990 and November 2011 sought to determine the comparative effectiveness and adverse effects of different surgical options for inguinal hernia in adults and children. There were 123 randomized controlled trials (RCTs), 2 registries, and 26 studies with other designs. This summary, based on the full report of research evidence, is provided to inform discussions of options with patients and to assist in decisionmaking along with consideration of a patient's values and preferences. However, reviews of evidence should not be construed to represent clinical recommendations or guidelines. The HTML version of this clinician research summary provides links to the full report for a more detailed discussion of the studies included in each analysis. The full report and the HTML version of this clinician research summary are available at [www.effectivehealthcare.ahrq.gov/inguinal-hernia.cfm](http://www.effectivehealthcare.ahrq.gov/inguinal-hernia.cfm).

## Background

Surgical repair of inguinal hernias is the most commonly performed general surgical procedure in the United States. Such a large volume of procedures suggests that even modest improvements in patient outcomes would substantially improve population health. The primary goals of surgery include preventing strangulation, repairing the hernia, minimizing the chance of recurrence, returning the patient to normal activities quickly, improving quality of life, and minimizing postsurgical discomfort and the adverse effects of surgery. Recurrence occurs in approximately 1 to 5 percent of cases of inguinal hernia.

Surgical procedures for inguinal hernia repair generally fall into three categories: open repair without a mesh implant (i.e., sutured), open repair with a mesh, and laparoscopic repair with a mesh. The near-universal adoption of mesh means that the most relevant questions about hernia repair involve various mesh procedures. However, mesh is not recommended for repair of pediatric inguinal hernia for several reasons including concerns about inflammatory reactions, damage to the vas deferens and/or testes, infertility, and growth-related complications. The findings from the research review presented here may inform clinical decisions by patients and surgeons, treatment recommendations by professional societies, purchasing decisions by hospitals, and coverage decisions by third-party payers.

## Conclusions

The typical adult in the studies included in this review was a man in his mid 50s, who is of average weight (median body mass index 25.3 kg/m<sup>2</sup>; interquartile range 25.0–26.7), and who had an elective repair of a primary unilateral inguinal hernia. About a quarter of the men worked in physically strenuous jobs; for these men, a durable repair is important to prevent a recurrence. The results of the review may inform decisions these men face. It is unclear how these results apply to women. However, it is also unclear how these results apply to men of other age groups.

Results indicate that laparoscopic repair of an inguinal hernia is associated with faster recovery times and less risk of long-term (≥6 months) pain; for recurrent hernia, such repair

may also lower the risk of another hernia recurrence. Open hernia repair, however, is familiar to more surgeons. Such repair may be associated with fewer internal injuries and may have lower recurrence rates in the context of a primary inguinal hernia. Limited evidence suggests that choosing to repair a pain-free or minimally symptomatic inguinal hernia with a Lichtenstein or tension-free mesh repair over watchful waiting may improve quality of life; however, this may not be applicable to other types of repair procedures, and the evidence on adverse effects is inconclusive.

Research found most of the meshes or fixation methods to be equivalent in their effectiveness and risk of adverse effects with only a few exceptions. There are numerous reports that the risk of recurrence decreases when a more experienced surgeon performs a repair, but there are not enough congruent studies to perform a meta-analysis.

## Clinical Bottom Line

### Comparative Effectiveness of Interventions for Primary, Bilateral, or Recurrent Hernias

#### Pain-Free Primary Hernia

- If a patient has a pain-free or minimally symptomatic primary hernia that is not interfering with normal activities, a mesh repair may improve their overall health status at 12 months versus those on watchful waiting (difference in mean SF-36 scores = 7.3; 95% CI, 0.4 to 14.3). ●○○

(Continued on next page)

#### Strength of Evidence Scale

- High: ●●● High confidence that the evidence reflects the true effect. Further research is very unlikely to change our confidence in the estimate of effect.
- Moderate: ●●○ Moderate confidence that the evidence reflects the true effect. Further research may change our confidence in the estimate of effect and may change the estimate.
- Low: ●○○ Low confidence that the evidence reflects the true effect. Further research is likely to change our confidence in the estimate of effect and is likely to change the estimate.
- Insufficient: ○○○ Evidence is either unavailable or does not permit a conclusion.



## Clinical Bottom Line (Continued)

### Comparative Effectiveness of Surgical Interventions for Primary, Bilateral, or Recurrent Hernias (Continued)

#### Pain-Free Primary Hernia (Continued)

- There is not enough information to know if there are differences in long-term pain at rest or during movement, long-term pain that interferes with activities, or acute hernia/strangulation for patients with a pain-free or minimally symptomatic hernia who have a mesh repair versus those on watchful waiting. ○○○

#### Painful Primary Hernia

- Laparoscopic repair results in a faster return to normal activities and work when compared with open repair. ●●●
- Laparoscopic repair results in less long-term pain than open repair. ●●○
- Open repair may have a lower rate of recurrence than laparoscopic repair. ●○○
- The length of hospital stay is similar for both types of surgery. ●○○
- Laparoscopic repairs have lower rates of hematoma (●○○) and wound infection (●●○) than open repairs.
- Open repairs have lower rates of epigastric vessel injuries than laparoscopic repairs. ●○○

#### Bilateral Hernia

- Patients with bilateral hernias return to work about 2 weeks sooner after laparoscopic (TAPP or TEP) repair versus open (Lichtenstein or Stoppa) repair. ●○○
- Evidence is inconclusive on the comparative adverse effects for laparoscopic versus open repair of bilateral hernias. ○○○

### Comparative Effectiveness of Surgical Interventions for Primary, Bilateral, or Recurrent Hernias (Continued)

#### Recurrent Hernia

- Several outcomes favor laparoscopic (TAPP or TEP) repair over open (Lichtenstein or Stoppa) repair:
  - Return to normal daily activities about 7 days earlier ●●●
  - Less likelihood of experiencing long-term pain (odds ratio = 0.24; 95% CI, 0.08 to 0.74) ●●○
  - In repair of recurrent hernias, lower re-recurrence rates (7.5% for laparoscopic repair vs. 12.3% for open repair) ●○○
- Evidence is inconclusive for all other outcomes and comparative adverse effects of laparoscopic versus open repair of recurrent hernias including epigastric vessel injury, hematoma, urinary retention, and wound infection. ○○○

#### Pediatric Hernia (Ages 3 Months to 15 Years)

- Laparoscopic and open high ligation repair of pediatric hernias both have similar outcomes for return to daily activities. ●○○
- For laparoscopic versus open high ligation repair of pediatric hernias, laparoscopic repair is favored for:
  - Length of hospital stay ●●○
  - Long-term patient/parent satisfaction ●○○
  - Long-term cosmesis ●○○
- Data on adverse effects are not reported. ○○○

95% CI = 95-percent confidence interval; SF-36 = 36-Item Short Form Health Survey; TAPP = transabdominal preperitoneal; TEP = totally extraperitoneal

## Surgical Bottom Line

### Comparative Effectiveness of Open Mesh-Based Repair Procedures

- Different open repair procedures yielded similar results, except that Lichtenstein repair may allow a 4-day earlier return to work when compared with a mesh plug. ●●○
- Lichtenstein repair is associated with lower rates of seroma than repair with a mesh plug. ●●○

### Comparative Effectiveness of Laparoscopic Mesh-Based Repair Procedures

- Rates of short-term pain (●●○), intermediate-term pain (●○○), and long-term pain (●○○) are equivalent for both the TAPP and TEP repairs.
- TAPP repair may offer a 1.4-day earlier return to work; however, this difference may not be clinically significant. ●●○
- Research on comparative adverse effects between TAPP and TEP repairs is inconclusive for hematoma, urinary retention, and wound infection. ○○○

### Comparative Effectiveness of Surgical Materials and Fixation Methods

#### Mesh Material

- Hernia recurrence occurs at similar rates with polypropylene mesh versus combination materials.\* ●●○
- Long-term pain after surgery is similar for standard polypropylene mesh when compared with biologic mesh or light-weight polypropylene mesh. ●○○
- Evidence on comparative adverse effects for the different types of mesh materials is inconclusive. ○○○

#### Fixation Methods

- After laparoscopic surgery, recurrence rates are similar for tacks or staples versus no fixation. ●●○
- Mesh fixations with sutures or with glue during open or laparoscopic surgery are associated with similar recurrence rates (●●○) and long-term pain outcomes (●○○) for both procedures.
- Mesh fixation with fibrin glue during TAPP repair results in less long-term pain than when the mesh is fixed with staples. ●●○
- Data on adverse effects are either missing or inconclusive. ○○○

\* Descriptions of the combination material mesh analyzed for this outcome can be found in the full report.

**Table 1. Comparative Effectiveness of Open Versus Laparoscopic Mesh-Based Repair of Painful Primary Hernias in Adults (N = 179,338; 38 Studies)**

Outcome	Surgery Favored	Calculated Differences (95% CI)	Strength of Evidence
Hernia recurrence	Open surgery	RR = 1.43 (1.15 to 1.79); a 2.49% recurrence rate after open repair versus a 4.46% recurrence rate after laparoscopy	●○○
Length of hospital stay	Approximate equivalence	Summary difference in means = 0.33 days (0.14 to 0.52)	●○○
Return to normal daily activities	Laparoscopic	Summary weighted mean difference in days = 3.9 (2.2 to 5.6)	●●●
Return to work	Laparoscopic	Summary weighted mean difference in days = 4.6 (3.1 to 6.1)	●●●
Long-term pain	Laparoscopic	OR = 0.61 (0.48 to 0.78)	●●○
Hematoma	Laparoscopic	OR = 0.696 (0.553 to 0.875)	●○○
Wound infection	Laparoscopic	OR = 0.49 (0.33 to 0.71)	●●○
Epigastric vessel injury	Open	OR = 2.1 (1.1 to 3.9)	●○○
Small-bowel injury	Inconclusive	OR = 0.715 (0.112 to 4.555)	○○○
Small-bowel obstruction	Inconclusive	OR = 2.159 (0.583 to 8.001)	○○○
Urinary retention	Inconclusive	OR = 1.247 (0.836 to 1.861)	○○○
Spermatic cord injury	Inconclusive	<ul style="list-style-type: none"> <li>■ In one study, 0 in 67 open repairs and 0 in 122 laparoscopic repairs</li> <li>■ In a second study, 1% after open repair (8/994) and 0.1% after laparoscopic repair (1/989)</li> </ul>	○○○

95% CI = 95 percent confidence interval; OR = odds ratio; RR = relative risk

## Description of Common Interventions Used To Repair Inguinal Hernias\*

<p><b>Laparoscopic Repair Techniques With a Mesh</b></p> <p><b>Intraperitoneal onlay mesh technique:</b> A hernia repair procedure wherein a mesh is placed under the hernia defect intra-abdominally to circumvent a groin dissection</p> <p><b>Totally extraperitoneal (TEP) repair:</b> A laparoscopic repair procedure wherein surgeons do not enter the peritoneal cavity but use a mesh to cover the hernia from outside the peritoneal space</p> <p><b>Transabdominal preperitoneal (TAPP) repair:</b> A laparoscopic repair procedure wherein surgeons enter the peritoneal cavity, incise the peritoneum, enter the preperitoneal space, and place the mesh over the hernia; the peritoneum is then sutured and tacked closed</p> <p><b>Open Repair With a Mesh</b></p> <p>Kugel® Patch repair†: A hernia repair procedure wherein an oval-shaped mesh that is held open by a memory recoil ring is inserted behind the hernia defect and held in place with a single absorbable suture</p> <p>(Continued in next column)</p>	<p><b>Open Repair With a Mesh (Continued)</b></p> <p><b>Lichtenstein:</b> A tension-free open hernia repair wherein a surgeon sutures mesh in front of the hernia defect</p> <p><b>Mesh plug:</b> A procedure wherein a surgeon introduces a preshaped mesh plug into the abdominal weakness during open surgery and places a piece of flat mesh on top of the hernia defect</p> <p><b>PROLENE™ Hernia System:</b> A one-piece mesh device constructed of an onlay patch connected to a circular underlay patch by a mesh cylinder</p> <p><b>Stoppa:</b> A procedure wherein a large polyester mesh is interposed in the preperitoneal connective tissue between the peritoneum and the transversalis fascia to prevent visceral sac extension through the myopectineal orifice</p> <p>* A complete list of included interventions can be found in the comparative effectiveness review at <a href="http://www.effectivehealthcare.ahrq.gov/inguinal-hernia.cfm">www.effectivehealthcare.ahrq.gov/inguinal-hernia.cfm</a>.</p> <p>† The U.S. Food and Drug Administration has recalled the Bard Composix® Kugel® Mesh Patch manufactured before October 2005, 14 lot numbers of XenMatrix™ Surgical Graft, and 15 lot numbers of Bard™ Flat Mesh.</p>
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## Gaps in Knowledge

- How the surgeon's experience influences surgical outcomes such as recurrence and pain
- The comparative effectiveness and adverse effects of laparoscopic repair versus watchful waiting for minimally symptomatic hernias in adults
- The comparative effectiveness and adverse effects of contralateral exploration/repair versus watchful waiting in the pediatric population
- More evidence on several outcomes related to the comparisons of mesh products and fixation methods including recurrence rates, perception of a foreign body, long-term pain, and infection rates
- Clarification in future studies of whether the population includes emergent as well as elective surgeries and whether or not the findings apply equally to both populations

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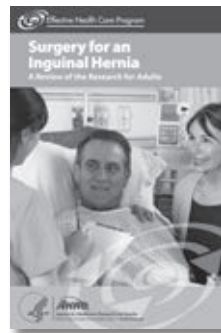
## What To Discuss With Your Patients

- If repair or watchful waiting is the right decision for their pain-free or minimally symptomatic inguinal hernia
- How to choose between open or laparoscopic surgery if the option is available
- What to expect from open or laparoscopic repair as far as outcomes and adverse effects, including the risk of long-term chronic pain
- What to do if the hernia recurs

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## Resource for Patients

*Surgery for an Inguinal Hernia, A Review of the Research for Adults* is a free companion to this clinician research summary. It can help patients talk with their health care professionals about the decisions involved with the care and maintenance of an inguinal hernia. It provides information about:



- Types of operative treatments
- Current evidence of effectiveness and harms
- Questions for patients to ask their health care professionals

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## Ordering Information

For electronic copies of *Surgery for an Inguinal Hernia, A Review of the Research for Adults*, this clinician research summary, and the full systematic review, visit [www.effectivehealthcare.ahrq.gov/inguinal-hernia.cfm](http://www.effectivehealthcare.ahrq.gov/inguinal-hernia.cfm). To order free print copies, call the AHRQ Publications Clearinghouse at 800-358-9295.

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## Source

The information in this summary is based on *Surgical Options for Inguinal Hernia: Comparative Effectiveness Review*, Comparative Effectiveness Review No. 70, prepared by the ECRI Institute Evidence-based Practice Center under Contract No. HHSA 290-2007-10063 for the Agency for Healthcare Research and Quality, August 2012. Available at [www.effectivehealthcare.ahrq.gov/inguinal-hernia.cfm](http://www.effectivehealthcare.ahrq.gov/inguinal-hernia.cfm). This summary was prepared by the John M. Eisenberg Center for Clinical Decisions and Communications Science at Baylor College of Medicine, Houston, TX.